

MERRIMACK RIVER BASIN
SANBORNTON, NEW HAMPSHIRE

MOUNTAIN POND DAM

NH 00464

NHWRB 211.07

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

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21. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam is an earth embankment, 97 ft. long and 14 ft. high. It is small in size with a low hazard potential. The test flood is in the range of a 50 to 100 year frequency. The condition of the dam is considered to be fair, requiring that modifications be made by the owner within 1-2 years after receipt of this inspection report.			

MOUNTAIN POND DAM

NH 00464

MERRIMACK RIVER BASIN
SANBORNTON, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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PHASE I INSPECTION REPORT

IdentificationNo.: NH 00464
Name of Dam: MOUNTAIN POND DAM
Town: Sanbornton
County and State: Belknap County, New Hampshire
Stream: Tributary of Pemigewasset River
Date of Inspection: May 31, 1978

BRIEF ASSESSMENT

Mountain Pond Dam is located on the north end of Mountain Pond in Sanbornton, N. H. , in mountainous terrain two miles south of the village of New Hampton. The dam is an earth embankment, 97 feet long and 14 feet high with a gated 8-inch outlet. The impoundment stores the water supply for the Town of New Hampton and is also the fire protection reserve.

In 1956 the dam was reconstructed over an original rock crib dam built in 1913 and, concurrently, a spillway at the south end of the pond was rebuilt. The only other potential outlet is a low lying swale on the east side of the pond which would act as an emergency spillway in times of high flow.

The drainage area of the dam is only 206 acres and is heavily wooded and steeply sloping. The dam normally impounds only 100 acre-feet with a freeboard of 1.5 feet.

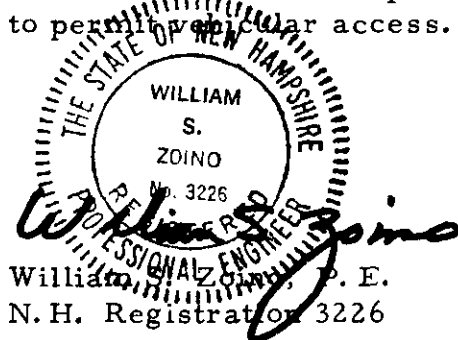
The dam's size classification is, accordingly, SMALL and its hazard classification is LOW, since overflows would largely be deflected away from populated areas. Natural drainage for overflows is toward the northeast and southeast and only about 40 percent of the flows would be conducted along the man-made channel leading to New Hampton.

Based on size and hazard classification in accordance with Corps guidelines, the test flood is in the range of a 50 to 100 year frequency. The test flood has a peak inflow of 200 cfs (620 csm), with a peak outflow reduced for surcharge storage of 125 cfs (390 csm). Discharge stage capacity curves were developed for three possible outflow locations and indicated that the main dam itself would not be overtopped, but freeboard would be seriously reduced.

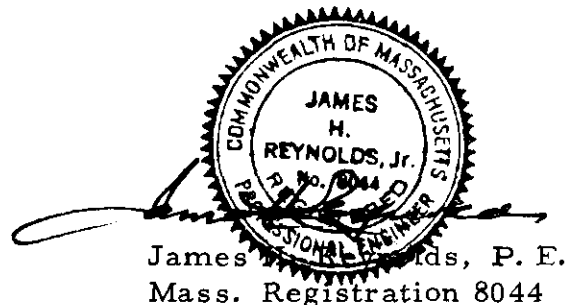
The condition of the dam is considered as FAIR, requiring that modifications be made by the owner within 1 - 2 years after receipt of the Phase I Inspection Report.

Recommendations include: cutting of brush and saplings should be intensified on the downstream slope; debilitated gate manhole cover should be repaired; a permanent facility should be provided for the gate stem, now merely placed in the nearby underbrush; the owner should investigate methods by which freeboard may best be protected when threatened by the STF and submit the proposals for review and comment to the N. H. Water Resources Board. Alternatives would include optimum methods of raising the dam crest, supported by adequate design data, or increasing discharge capacity, including the broadening of the east swale.

The remoteness of the site and its inaccessibility compound operational and maintenance problems. The trail road should be improved to permit vehicular access.



William S. Zoino, P. E.
N.H. Registration 3226



James H. Reynolds, Jr., P. E.
Mass. Registration 8044

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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Overview from right abutment



Overview from left abutment



- SCALE -



FROM: USGS HOLDERNESS
QUADRANGLE MAP

GOLDERS, ZOINO, DUNNCLIFF & ASSOC, INC.
GEOTECHNICAL CONSULTANTS
NEWTON UPPER FALLS, MASS.

U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

LOCUS PLAN

MOUNTAIN POND DAM

NEW HAMPSHIRE

FILE No 2067

SCALE AS NOTED

DATE JULY 1978

PHASE I INSPECTION REPORT
MOUNTAIN POND DAM, NH 00464
NHWRB 211.07

SECTION 1 - PROJECT INFORMATION

1.1 General

(a) Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Goldberg, Zoino, Dunnicliff & Associates, Inc. (GZD) has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to GZD under a letter of May 3, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0303 has been assigned by the Corps of Engineers for this work.

(b) Purpose

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) Update, verify and complete the National Inventory of Dams.

(c) Scope

The program provides for the inspection of non-Federal dams in the high hazard potential category based upon location of the dams, and those dams in the significant hazard potential category believed to represent an immediate danger based on condition of the dams.

1.2 Description of Project

(a) Location

The dam is located in the Merrimack River Basin on the north end of Mountain Pond in the town of Sanbornton, N. H. , two miles south of the village of New Hampton, N. H. , as shown on the Locus Plan adapted from the USGS quadrangle for Holderness, N. H. Access to the site by off-road vehicles and by foot is via a trail road off Gordon Hill Road, 0.6 miles south of the village.

(b) Description of Dam and Appurtenances

The dam is an east-west earth embankment, about 97 feet long and about 14 feet high. The dam was constructed over an existing double-walled rock crib dam, which now forms the submerged upstream face of the reconstructed dam (see Appendix B). The impounded pond is essentially spring fed. The dam is penetrated by an 8 inch pipe with a hand operated stem gate in a concrete manhole, continually discharging at a predetermined rate to an outlet channel, which in turn leads to a small distribution reservoir, a fish hatchery, and the Pemigewasset River, a tributary to the Merrimack.

Mountain Pond is also served by a spillway at the south end of the Pond. The 24 foot long, planked spillway is incorporated into a rock-filled dam, timber-faced on its upstream side. The spillway is approximately 1.5 feet lower than the crest of the main dam. The discharge channel leads to Hadley Brook, thence to Hermit Lake to the southeast. A natural swale is present some 800 feet south of the dam on the east shore of the pond and being only about 0.3 feet higher than the south spillway, can be expected to perform as an auxiliary spillway when the pond receives high flows.

(c) Size Classification

The dam is 14 feet high, normally impounds 100 acre feet and is thus classified as SMALL. The height and impoundment are well below the respective criteria of 25 feet and 1,000 acre feet established by the "Guidelines" for that category.

(d) Hazard Classification

Although the dam is upstream of New Hampton, the main thread of stream to the village is in a man-made channel constructed for water supply and fire protection. Natural drainage is to the northeast, toward Spectacle Pond. Further, a low point in the pond's easterly shore line would also tend to conduct overflows away from the town. The emergency spillway discharges to the southeast to Hermit Lake. Thus, any flows resulting from failure of the dam would largely be deflected away from populated areas and the hazard potential is thus considered as LOW.

(e) Ownership

The dam is owned by the New Hampton Fire Precinct. Mr. Wendell Stevenson is Commissioner of the precinct and can be reached at 603-744-3037. The Fire Chief is Mr. John Powers, 603-744-8253.

(f) Operator

The dam is operated for the precinct by Mr. Arthur Kidder, 603-744-3678, who resides on Gordon Hill Road at the foot of the dam's access trail-road.

(g) Purpose of Dam

The dam supplies the downstream New Hampton water supply reservoir and serves as the fire protection reserve.

(h) Design and Construction History

The original dams at the site were built in 1913 when the town's water system was installed. In 1956 the north and south structures were both rebuilt substantially in accordance with the intent of plans and specifications prepared in 1953 by the New Hampshire Water Resources Board (Appendix B). The designer and contractor for the first work and the contractor for the 1956 alterations are not known.

(i) Normal Operational Procedure

The dam operator has set the gate valve so that a relatively constant flow is always maintained and so that the dam requires little or no operational attention. The continuous flow coupled with the very small drainage area involved confirms the impression of the local residents that the pond is spring fed. The operator, Mr. Kidder, has been associated with the dam for over 25 years and, to his knowledge, the dam has never been seriously threatened by high flows.

1.3 Pertinent Data

(a) Drainage Area

Mountain Pond is situated in a natural bowl formed by three adjoining wooded mountains and its watershed of only 206 acres is correspondingly small. The shores of the pond are distinguished by many rock outcrops. Pond elevation and the elevation of the south spillway crest are estimated from the USGS quadrangle as 1060 feet above MSL.

(b) Discharge at Dam Site

(1) Outlet Works

Normal discharge at the site is through the 8 inch supply line, with overflows passing over the south spillway. The elevation of the 8 inch pipe at the gate structure is about 14 feet below the dam crest.

(2) Maximum known flood at damsite: Unknown

(3) Total ungated spillway capacity at maximum pool elevation: 172 cfs @ 1.5 ft. elev. above south spillway crest, plus flow of about 38 cfs @ 1.5 ft. above south spillway crest through east swale.

(c) Elevation (in ft. above south spillway crest, taken as 1060 MSL)

- (1) Top of dam - 1.5 ft.
- (2) Full pool - 1.5 ft.
- (3) South spillway crest - 0.0 ft.
- (4) East swale crest - 0.3 ft.
- (5) Streambed at center line of dam - minus 14 ft.

(d) Reservoir

- (1) Length - 1700 ft.
- (2) Storage - max. 150 acre ft.
normal - 100 acre ft.
- (3) Surface area - 24 acres

(e) Dam

- (1) Type - Earth fill, superimposed on earlier rock crib
- (2) Length - 97 ft.
- (3) Height - 14 ft.
- (4) Top width - 8 ft.
- (5) Side Slopes - 3:1
- (6) Zoning - Unknown
- (7) Impervious Core - Unknown
- (8) Cutoff - Unknown

(f) Spillway (South Outlet)

- (1) Type - Rock filled, crib dam, timber planked spillway and upstream facing
- (2) Length - 23.5 ft. ; south dam length 45.5 ft.
- (3) South spillway crest elevation - 1060 MSL, est.
- (4) South dam crest elevation - 1060.7 MSL, est.
- (5) Gates - None
- (6) D/S Channel - Heavily overgrown, rocky, no structures
- (7) General - East swale acts as emergency spillway

SECTION 2 - ENGINEERING DATA

2.1 Design

While no design data exist for Mountain Pond dam or for its south spillway, the design intent is clear from the known geometry and from the 1953 drawings and specification shown in Appendix B.

2.2 Construction

The 1956 dam was not constructed in absolute accord with the 1953 drawings, but it is inferred from records that its construction was monitored by responsible engineers. A final inspection is known to have been made by a Civil Engineer in June 1956.

2.3 Operation

Operational procedures are rudimentary, being confined to the infrequent adjustment of the gate to regulate water supply flow.

2.4 Evaluation of Data

(a) Availability

The availability of the engineering data, while minimal, permits an evaluation of the dam when combined with findings of the visual inspection.

(b) Adequacy

The lack of indepth engineering data did not allow for a definitive review. Therefore the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and engineering judgment.

(c) Validity

The visual inspection and hydrological analyses are of sufficient validity to permit satisfactory evaluations.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

(a) Dam

The dam (shown in the Figures of Appendix B) is in FAIR condition with no evidence of distress. However, the downstream slope was overgrown with stands of saplings, heavy brush and some birch trees up to 12 feet high (see Overview photos).

Freeboard is about 1.5 feet less than the minimum of 3 feet suggested by the American Society of Civil Engineers for a fetch less than 1 mile.

There is no evidence of seepage, and the dam appears to be well founded on firm glacial till. An old borrow pit of this material is near the left abutment, and appears to be at least 20 years old. It is possible that the dam was constructed from this source.

Rock is shallow, as evidenced by extensive nearby outcrops.

(b) Appurtenant Structures

Discharge works are generally in FAIR condition, with some exceptions. An open manhole for the gate valve is covered with random deteriorated boards, apparently the remains of a former wooden cover (Photo 1). The gate stem handle is kept some 10 feet from the manhole in the undergrowth, whence it is retrieved when the gate is to be operated. The gate operates without difficulty, but requires care and experience to set for the constant flow required to match the Town's water demand.

The downstream channel in the immediate vicinity of the dam is somewhat obstructed by growth (Photo 2).

The south spillway is essentially a rock-filled crib dam with a planked upstream face and a recessed planked spillway (Appendix B, Photo 3). Despite the 22 year age of the timber, it was in FAIR condition throughout, apparently having been expertly treated with preservative salts. No seepage was evident.

The channel downstream of the south spillway is heavily overgrown (Photo 4).

A hole, apparently caused by a burrowing rodent, is present on the left abutment of the south spillway (Photo 5), and correction is recommended herein. No structural danger attends.

(c) Reservoir Area

The entire east shore was closely inspected from the main dam to the south spillway. The shore line exhibits many outcrops and is considered stable.

Some 800 feet upstream of the right abutment there is a natural swale, or low point, in the shore line (Photo 6) which, being only slightly higher than the south spillway, would act as an emergency spillway discharging to the northeast.

3.2 Evaluation

The visual inspection revealed sufficient data to permit an assessment of the dam's general condition relative to safety.

SECTION 4 - OPERATIONAL PROCEDURE

4.1 Procedures

As indicated earlier, operational procedures are limited to adjusting the 8-inch outlet gate valve to regulate the flow to the water supply reservoir. No occasion has ever arisen, according to the operator, wherein a draw-down was required to discharge threatening flows. To this date, apparently, such flows have been satisfactorily discharged over the south spillway.

The operator's duties include visiting the site and inspecting the works once per week.

4.2 Maintenance of Dam

Occasional brush cutting on the crest of the dam appears to be effective, but the downstream slope is unacceptably overgrown with heavy brush and saplings.

4.3 Maintenance of Operating Facilities

The only operating facility is the gate valve itself which is in satisfactory condition. However, the manhole cover is in serious disrepair and there is no permanent on-site location for the gate valve handle.

4.4 Description of Warning System

There is no warning system in effect.

4.5 Evaluation

The established operational procedures for Mountain Pond Dam are generally satisfactory. Additional emphasis on routine maintenance will assist the owners in assuring the long term safety of the dam.

SECTION 5 - HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

(a) Design Data

The best available data source for the Mountain Pond North Dam is, as noted earlier, the plan for "Proposed General Specifications for Reconstruction for Dams on Mountain Pond, Sanbornton, New Hampshire for New Hampton Fire Precinct," as revised September 4, 1953 and the accompanying drawing prepared by the New Hampshire Water Resources Board (NHWRB) dated July 31, 1953. A secondary source is a dam inspection report completed by the NHWRB on November 30, 1977. All are contained in Appendix B.

(b) Experience Data

No recorded data on experienced flood peak discharges from Mountain Pond is known to be available, although, as noted in paragraph 1.2. (i), the New Hampton Fire Precinct's dam operator indicated that the North Dam had never been seriously threatened to the best of his knowledge.

(c) Visual Observations

As earlier described, the water surface elevation of Mountain Pond is controlled by two man-made dams and a natural low swale on the eastern shore line. The subject of this Report is the "North Dam," located at the northeast corner of the pond, with its regulating eight inch diameter discharge pipe. The crest of the North Dam is some one and one-half feet above the crest of the South Spillway at the southeast corner of the pond and the South Spillway, in turn, is 0.7 feet below its own dam's crest.

The inspection of the east shore of the pond revealed the low lying natural swale approximately one-half of the distance from the North Dam to the South Spillway, and since its high point is about 0.3 feet above the South Spillway, the swale will serve as an emergency spillway during extreme flooding conditions.

The exact width of this natural spillway, hereinafter called the East Swale, is difficult to assess due to the irregular topography of the area, but for analysis purposes, a value of 10 feet was assigned. This is to be on the conservative side of actual conditions observed at the East Swale.

The drainage area feeding the pond is only 206 acres, or 0.32 square miles. The drainage basin is heavily wooded and steeply sloped on the average. The normal pond surface area was estimated from USGS quads as 24 acres.

(d) Overtopping Potential

The hydrologic conditions of interest in this Phase I investigation are those that are required to assess the adequacy of the dam in terms of its overtopping potential and its ability to safely allow an appropriately large flood to pass. This involves investigations to determine how the recommended Spillway Test Flood (STF) compares with the discharge and storage capacities of the dam. Original hydraulic and hydrologic design records were not available for use in this study.

Spillway Test Flood guidelines based on the size and hazard potential classifications of the dam are specified in the "Recommended Guidelines" of the Corps of Engineers. As shown in Table 3 of the Guidelines, for a dam classified as SMALL in size with a LOW hazard potential, an appropriate STF would be between the 50-year and 100-year peak flows.

The magnitude of the 50 and 100-year peak inflows to the pond was estimated using two alternative methodologies. The first method utilized a series of regression equations developed by Dennis Le Blanc of the USGS and reported in "Progress Report on Hydrologic Investigations of Small Drainage Areas in New Hampshire," Water Resource Investigation 78-47, March 1978. The equations use as independent variables the drainage area, average slope and a rainfall index (the 24-hour, 2-year peak rainfall). The computations were carried out for this method, but, given the small drainage area (0.32 square miles), the appropriateness of the methodology is in doubt.

Thus, as a check, a Rational Formula computation was also carried out. The time of concentration for the pond was determined to be approximately 30 minutes. The 30-minute, 50-year, and 30-minute, 100-year rainfalls were then combined with runoff coefficients of 0.24 and 0.25 respectively, to predict the peak flows.

The results of these analyses were:

	Regression Equation (cfs)	Rational Formula (cfs)
Q_{50}	57	173
Q_{100}	71	201

Given the high degree of error associated with the Regression Formula for a very small drainage basin and the relatively higher accuracy of the Rational Formula, a Spillway Test Flood inflow of 200 cfs was selected as appropriate for this basin.

The peak inflow to the pond was reduced to account for surcharge storage in the pond in accordance with the methodology recommended by the Corps of Engineers (New England Division), "Estimating the Effect of Surcharge Storage on Maximum Probable Discharges." The result was a peak outflow from the pond of 125 cfs.

The storage-stage curve utilized in the routing through the pond was based on the assumption that surcharge storage was limited to the product of the surcharge in feet above the spillway crest and the normal surface area of the pond (24 acres).

The discharge-stage capacity curve for Mountain Pond was developed using the weir equation for the three possible overtopping locations. The first location is the South Spillway where the lower spillway weir (23.5 feet long) begins to discharge as soon as the pond level rises above its crest. This crest is the datum for all the discharge calculations which follow. H was defined as the water surface elevation of the pond in feet above the South Spillway crest.

When H is greater than 0.3 feet, water will begin to flow out through the East Swale overflow point. As stated earlier, this natural swale has been assigned a length of 10 feet. When H exceeds 0.7 feet, the length of the South Spillway increases to 43 feet. The North Dam is not overtopped until the pond rises 1.5 feet above the South Spillway crest. The eight inch diameter discharge pipe was assumed to be in its normal, partially open position, but that its contribution to the total flow was negligible.

The combined discharge capacity curve indicates that the STF-modified outflow of 125 cfs would result from a stage of approximately 1.15 feet above the South Spillway crest. Thus, the North Dam would not be overtopped under these conditions.

5.2 Hydrologic/Hydraulic Evaluation

The results of the hydrologic and hydraulic assessment of Mountain Pond indicate that the North Dam will not be directly overtopped by the recommended Spillway Test Flood, but the margin of freeboard is limited to 0.35 feet. Since this could easily be lost by even minor wave action, there exists a significant probability that the combination of the STF and some wind-generated waves could overtop the North Dam.

A conservative assumption has been made in this analysis for the width and level of the East Swale. No detailed survey information is available on this potential emergency spillway. Should this opening have significant additional capacity (i. e., 40 cfs at H = 1.5 feet), or were it to be cleared and lowered in the future, the potential for overtopping the North Dam for the recommended STF would be minimal.

The key to the safety of the North Dam lies in ensuring that the South Spillway is free of trash, brush, or other obstructions, and that the East Swale continues to provide emergency relief.

5.3 Downstream Dam Failure Hazard Estimates

Conditions downstream from the North Dam at Mountain Pond are somewhat unusual. The natural brook, which would carry the water from the North Dam, has been diverted toward New Hampton by a manmade water supply channel, instead of the brook following the natural topography toward Spectacle Pond. If the North Dam were to fail, it would appear that a large portion of the flood waters would overflow the diversion channel and follow the natural course toward Spectacle Pond and New Hampton would not experience the full effect of the flood wave.

The flood hazards in downstream areas that would result from a failure of the dam were estimated through the use of the procedure set forth in "Rule of Thumb Guidelines for Estimating Downstream Dam Failure Hydrographs," Corps of Engineers (NED), April 1978. This procedure allows the attenuation of dam failure hydrographs to be accounted for in computing flows and flooding depths for downstream area. These calculations take into account the basic hydraulic and storage characteristics of the stream reaches downstream of the dam.

For the purposes of these calculations, it was assumed that failure of the North Dam would occur when the dam is overtopped, or when the elevation of the pond is 1.5 feet above the South Spillway.

The area downstream of the North Dam was divided into four reaches for evaluation. The first reach is the area immediately below the dam and above the diversion point. The second reach is from the diversion point to the east toward Spectacle Pond following the natural topography. The third reach follows the diversion down the hill to just above the fish hatchery in New Hampton. The fourth reach is the flatter section of the stream flowing just to the south of the built-up section of New Hampton. For the analysis, it was assumed that sixty percent of the peak flow reaching the diversion point would flow to the east along Reach #2 and that only forty percent would follow Reach #3 toward New Hampton.

The estimated peak flow at the time of the hypothetical failure of North Dam is 2500 cfs. In Reach #1, the natural storage would reduce this flow to 2285 cfs at the diversion point. Based on the assumed distribution of flow below the diversion, the peak flow for Reach #2 is estimated as 1320 cfs, for Reach #3 as 850 cfs, and for Reach #4 as 810 cfs.

The resulting approximate flood depths for each reach would be: Reach #1 = 11.4 feet, Reach #2 = 8.0 feet, Reach #3 = 7.5 feet, and Reach #4 = 6.0 feet. Given the general lack of structures in Reaches #1, #2, and #3, these flood depths would only result in severe damage to the natural vegetation now growing in the stream channels. In Reach #4, the flooding would be fairly well confined to the channel and should not result in severe damages with the possible exception of the equipment and/or diversions at the fish hatchery.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

(a) Visual Observations

There are no design calculations available for review of the structural stability of the dam and appurtenant structures. However, the extensive field investigation and findings do not indicate any displacement and/or distress which would warrant the preparation of structural stability calculations based on assumed physical properties and technical values. The dam is presently stable, but the deficiencies noted in Section 7 should be corrected.

(b) Design and Construction Data

The original dam and south spillway were built in 1913 and were substantially rebuilt in 1956 to provide approximately two additional feet of storage capacity. NHWRB's plans and specifications for the change are included in Appendix B. Design calculations are not available.

(c) Operating Records

There are no known operating records for the dam.

(d) Post Construction Changes

There have been no known construction changes since the dam was rebuilt in 1956.

(e) Seismic Stability

The dam is located in Seismic Zone No. 2 and in accordance with recommended Phase I guidelines does not warrant seismic analyses.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

(a) Condition

The dam is in FAIR condition, but freeboard will be threatened by the Spillway Test Flood, about equal to the 100 year flood.

(b) Urgency

The dam is in no immediate danger under normal conditions, but recommendational and remedial action described below should be undertaken by the owner within 1 to 2 years after receipt of the Phase I Inspection Report.

(c) Need for Additional Information

If the dam crest is to be raised, or alternatively, the east swale broadened, then subsurface information will be necessary.

7.2 Recommendations

The owner should investigate alternate methods for protecting freeboard when the dam is threatened by the STF and submit his studies to the N. H. Water Resources Board for comment.

7.3 Remedial Measures

(a) Alternatives

Of the several options that might be considered for mitigating the threat of dam failure, including removing the dams, the most viable are considered to be combinations of raising the dam crest and providing additional discharge capacity.

(b) Operations and Maintenance Procedures

Diligent and periodic brush cutting on the downstream slopes of the main dam and the south spillway should be implemented and intensified.

The debilitated gate manhole cover should be replaced, and a permanent protected housing provided for the gate stem.

The rodent hole on the south spillway's left abutment should be backfilled with well-tamped granular soil.

The remoteness and inaccessibility of the site contribute to operational and maintenance difficulties. Consideration should be given to improving the trail road to allow the accommodation of at least off road vehicles, permitting ready access for routine inspection and maintenance and for rapid emergency entry. Periodic inspection should be instituted on at least an annual basis.

APPENDIX A
VISUAL INSPECTION CHECKLIST
MOUNTAIN POND DAM
NH 00464

INSPECTION TEAM ORGANIZATION

Date: 31 May 1978, 1:30 p.m.

Project: NH00464
Mountain Pond Dam
Sanbornton, New Hampshire
NHWRB 211.07

Weather: Sunny, warm

Inspection Team

James H. Reynolds	Goldberg, Zoino, Dunnicliff & Associates, Inc. (GZD)	Team Captain
William S. Zoino	GZD	Soils
Nicholas A. Campagna	GZD	Soils
Guillermo Vicens	Resource Analysis, Inc.	Hydrology

Owners Representative Present

Arthur Kidder, New Hampton Fire Precinct Dam Operator

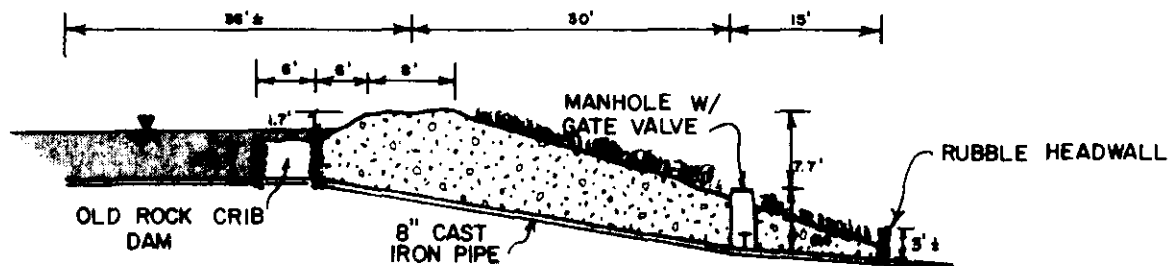
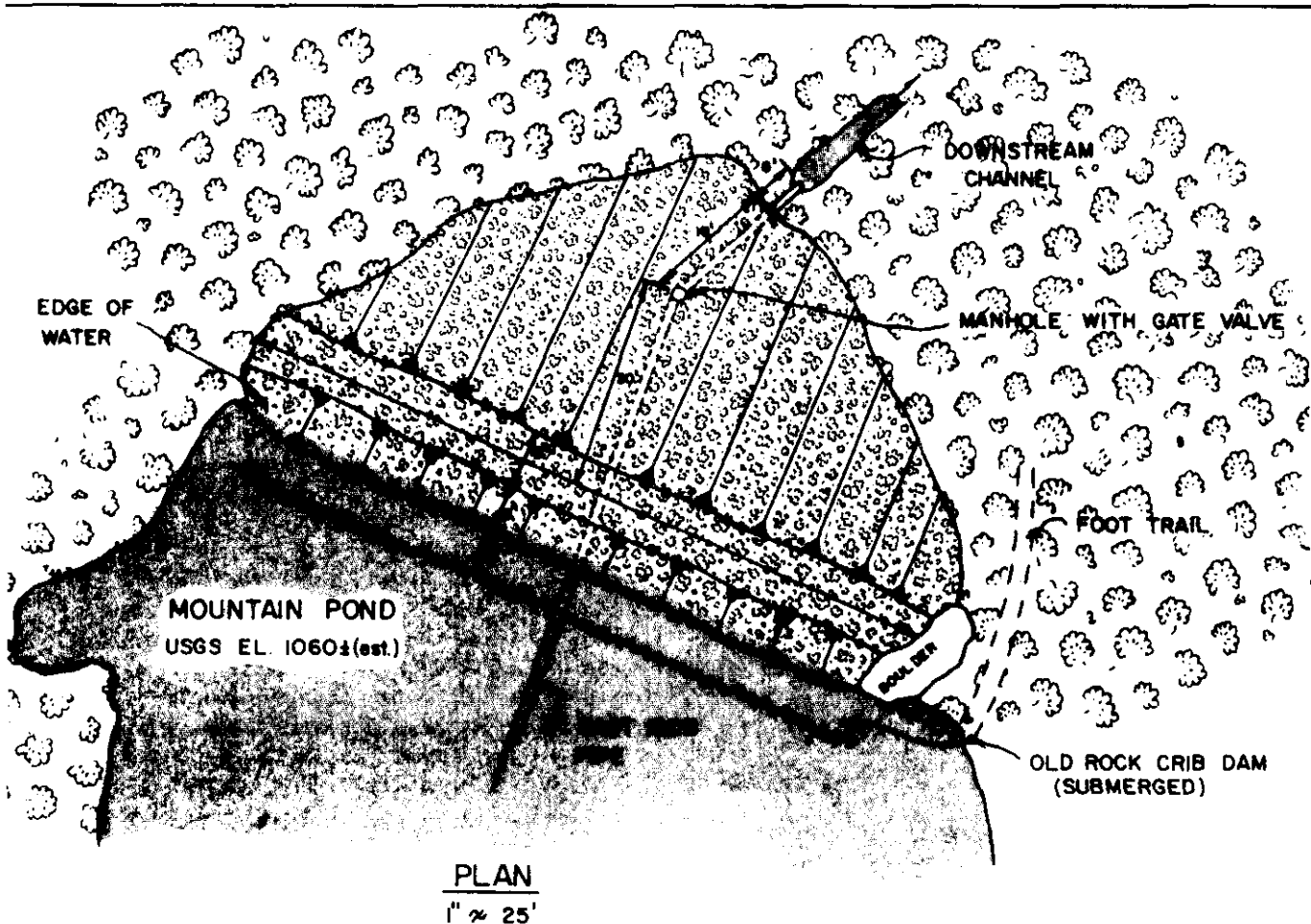
CHECK LISTS FOR VISUAL INSPECTION		
AREA EVALUATED	BY	CONDITION & REMARKS
<u>Dam Embankment</u>	<i>TAC</i>	
Surface Cracks		None
Settlement of Crest		None
Lateral movement		None
Trespassing on Slopes		None
Sloughing or erosion of slopes		Moderate erosion, 6 inches at upstream run-up zone
Freeboard		About 1.5 feet
Growth on dam		None on crest. Brush and saplings on downstream slope.
Rock slope protection		None, except original submerged rock crib, upstream
Unusual movement or cracking at or near toe		None
Unusual embankment or downstream seepage		None
Piping or boils		None
Foundation drainage features		None evident
Toe drains	None evident	
<u>Spillway South Outlet</u>		
Timber plank		Well preserved
Rock crib		Good
Abutments		Rodent hole in left abutment - right abutment good

CHECK LISTS FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITION & REMARKS
<u>Outlet Pipe</u>		
Operating condition of valve	MAC	Good, without any major effort. Requires care and experience to match flow with Town's water demand
Gate valve manhole		Fair, wooden cover deteriorated, consists of loose boards
Pipe outlet		Good, 8-inch cast iron pipe
Pipe inlet		Submerged, not visible
<u>Outlet Channels</u>		
North Outlet channel	MAC	Narrow man-made cut that diverts water toward New Hampton rather than its natural course to Spectacle Pond. Heavily wooded, and rocky. No development for at least 2 to 3 miles downstream
South Outlet channel		Heavily wooded and rocky. No development for at least two to three miles downstream
<u>Reservoir</u>		
Shoreline	MAC	Stable, heavily wooded
Upstream hazard areas in event of backflooding		None
Changes in nature of watershed		None, watershed heavily wooded and mountainous. Unpopulated, relatively inaccessible.

Appendix B

		<u>Page</u>
Fig. 1	Site Plan	B - 2
Fig. 2	Plan and Section of Dam	B - 3
Fig. 3	Elevation, Section and Plan of Dam	B - 4
	Drawing dated 31 Jul 53 by NHWRB of proposed reconstruction	B - 5
	Letter erroneously dated 11 Jan 77 (should be 11 Jan 78) from the NHWRB to the New Hampton Fire Precinct concerning the results of a 30 Nov 77 NHWRB inspection	B - 6
	Letter dated 20 Jun 56 from the NHWRB to the Precinct concerning a 19 Jun 56 NHWRB inspection	B - 7
	Specifications prepared by the NHWRB for the reconstruction of the dam and spillway	B - 8



NOTES:

- 1) WATER LEVEL MEASURED 31 MAY 78.
- 2) EXACT VERTICAL ALIGNMENT AND UPSTREAM LOCATION OF OUTLET PIPE "NOT KNOWN."
- 3) THIS DRAWING IS A MODIFICATION OF NHWRD DRAWING DATED 31 JULY 53 (PAGE B-5) BASED UPON THE INSPECTION OF 31 MAY 78.

GOLDERS, ZOMO, DUNCLIFF & ASSOC., INC.
GEOTECHNICAL CONSULTANTS
NEWTON UPPER FALLS, MASS.

U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTON, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

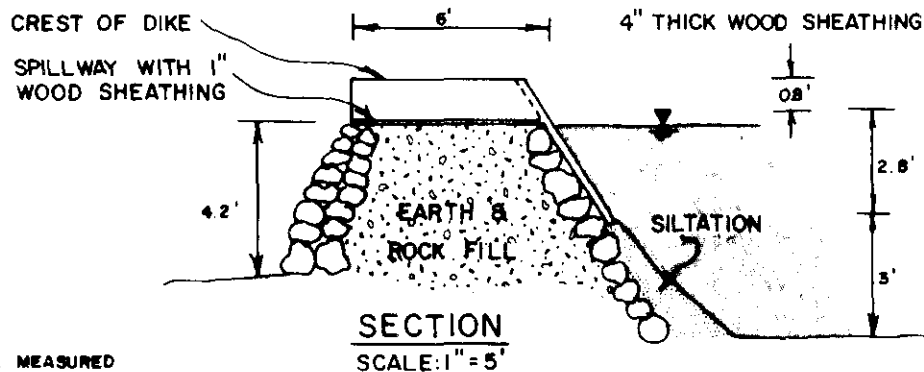
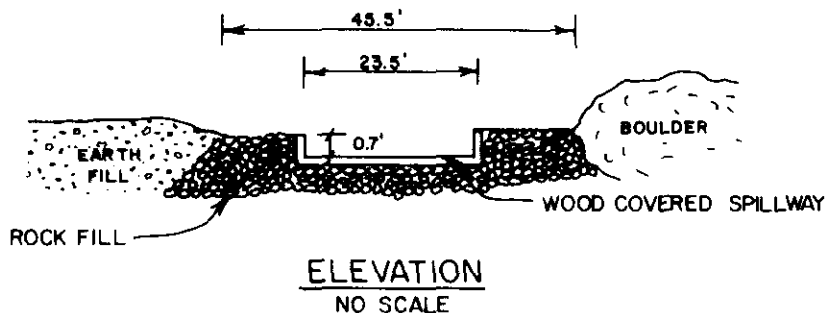
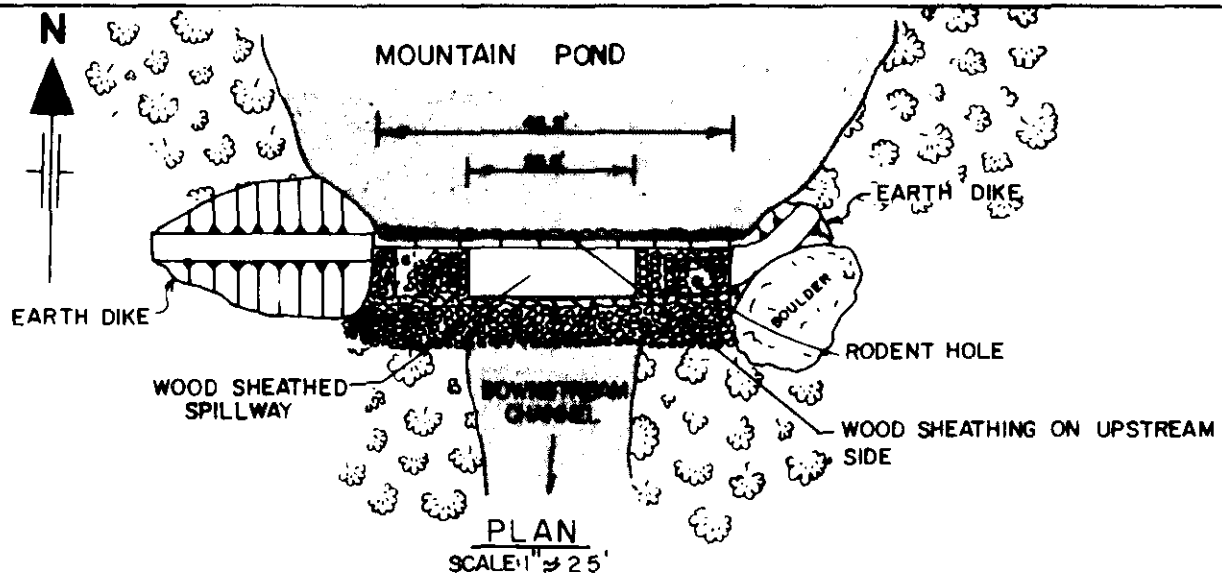
FIG. 2

PLAN AND SECTION OF MAIN DAM

MOUNTAIN POND

NEW HAMPSHIRE

SCALE AS NOTED
DATE JULY 1978



NOTE:
WATER LEVEL MEASURED
31 MAY 78.

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NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

FIG. 3

PLAN, ELEVATION AND SECTION OF SOUTH SPILLWAY

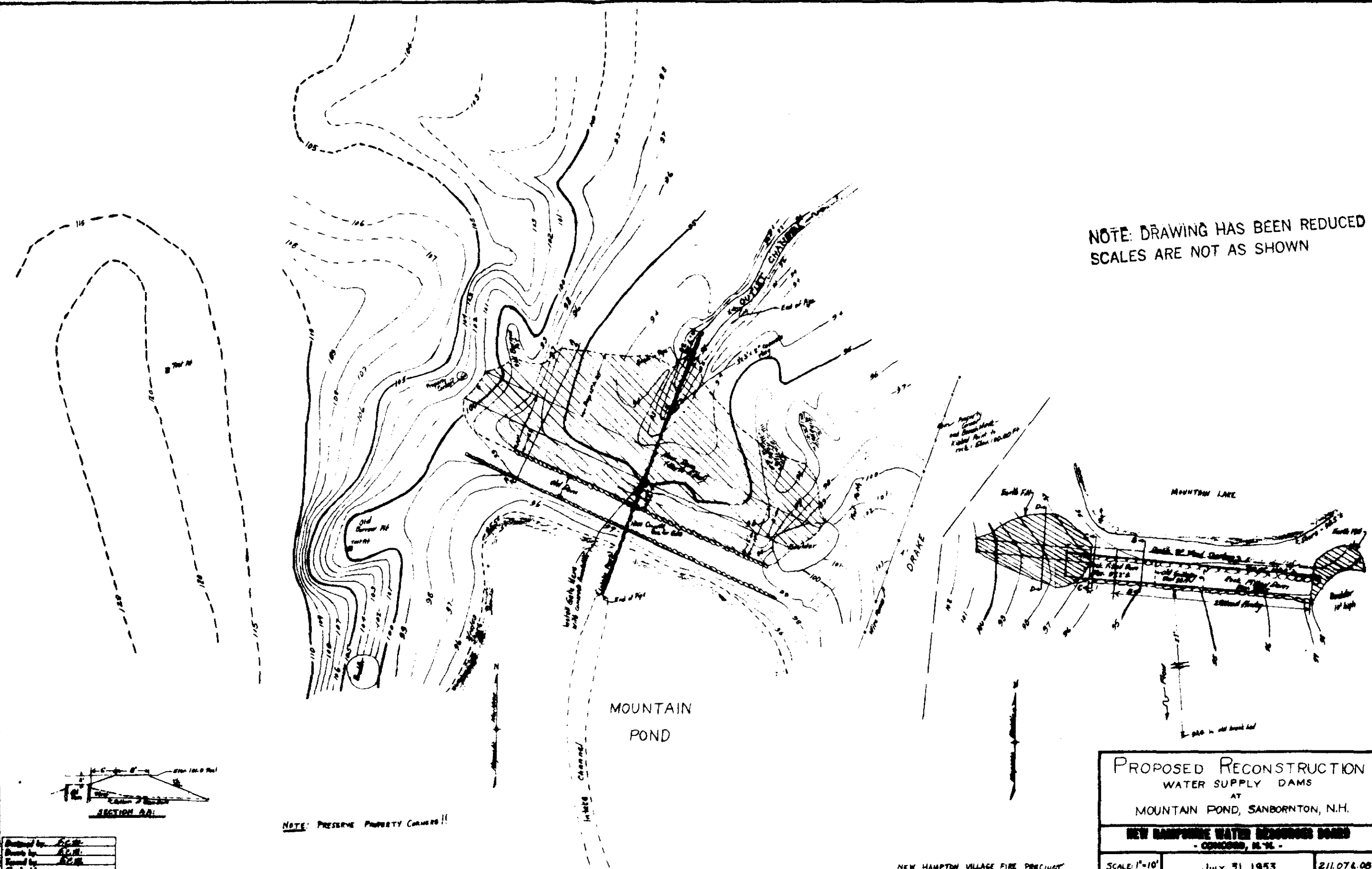
MOUNTAIN POND

NEW HAMPSHIRE

SCALE AS NOTED
DATE JULY 1978

FILE No. 2067

NOTE: DRAWING HAS BEEN REDUCED
 SCALES ARE NOT AS SHOWN



NOTE: PRESERVE PROPERTY CORNERS!!

Designed by: S.C.M.
 Drawn by: S.C.M.
 Checked by: S.C.M.

NEW HAMPTON VILLAGE FIRE PRECINCT

State of New Hampshire
WATER RESOURCES BOARD

CONCORD 03301

January 11, 1977

Mr. Harold T. Chase, Commissioner
New Hampton Fire Precinct
New Hampton, NH 03256

Dear Mr. Chase:

Your precinct's dam at the north end of Mountain Pond under the provisions of RSA Chapter 482, Sections 8 through 15, copy enclosed, was inspected on the 30th of November 1977 by an engineer of the New Hampshire Water Resources Board. This dam (#211.07) is classified in the files of The U.S. Army Corps of Engineers as a menace structure because of its location upstream of populated areas. As such, it must be maintained in a manner not to endanger public safety nor become a dam in disrepair.

As a result of this inspection it is noted that an item of maintenance or repair is in need of attention and so annotated here. Bushes and the like are growing on the dam and should be removed because this will prevent possible damage to the embankment or structure by the roots or by an entire tree being uprooted.

Because this dam is classified as a menace structure, we require a schedule of your proposed repairs within a month's time. If you have any questions, please contact us at your convenience.

Very truly yours,


George M. McGee, Sr.
Chairman

GMMG:GK:njk

Enc.

cc: Board of Selectmen

B-6

LIVE FREE OR DIE

June 20, 1956

Mr. Harold T. Chase, Commissioner
New Hampton Fire Precinct
New Hampton, New Hampshire

Dear Mr. Chase:

After talking with you yesterday afternoon, I went up to both dams on Mountain Pond. The work has been done in a workmanlike manner and should last a long time.

There were two observations that I made which should be considered by the Fire Precinct:

(1) The earth slopes of the two dams could very profitably be fertilized, seeded and covered lightly with hay. By using a quick growing nurse grass with more perennial grasses, the slopes would become well stabilized. (No extensive erosion has taken place yet.) This could be done in the fall just before heavy rains.

(2) Due to raising of the level of Mountain Pond, many trees have been flooded and will die. These should be cut and removed from the pond area. This work could be done in winter if the full lake shore line can be found easily. Floating debris from dead trees will tend to clog the south spillway.

Water was within two inches of flowing out the south spillway. The big swamp, now flooded, between the two dams on the east side of the pond will spill when the water is a very few inches over the south spillway. This natural spillway is a good safety valve for the south spillway.

Very truly yours,

Francis C. Moore
Civil Engineer

fcm:c

Harold T Chase

PROPOSED GENERAL SPECIFICATIONS FOR RECONSTRUCTION
OF DAMS ON MOUNTAIN POND, SANBORNTON, N. H.
FOR NEW HAMPTON FIRE PRECINCT

DAM EMBANKMENT

1. All organic matter including loam shall be removed from the site of the new dam before fill is placed.
2. The borrow area shall have all stumps, loam and organic material removed before excavating borrow for the fill.
3. The downstream embankment to the old dam shall be excavated, as shown in Section AA, before placing fill. (If this material is suitable, it can be used for fill.)
4. The fill shall be placed and compacted to six-inch layers. All rocks four inches or larger shall be removed in the borrow area or before the fill is compacted at the dam. These rocks may be placed at the downstream toe of the new dam.
5. The fill in the dam shall be well compacted by frequent passes of the bulldozer.
6. The fill shall be placed to line and grade as shown on the plan.
7. Only impervious and semi-pervious material shall be used as fill.
8. Care shall be taken that the two property bounds are not disturbed, unless this property is acquired prior to construction.
9. New cast iron pipe shall be laid from the dam end of the intake channel to 6' beyond the toe of dam in the outlet brook.
10. The gate stem to the discharge valve shall be placed on a 2' x 3' x 1' concrete base (using 1: 3: 5 concrete).
11. Each joint in the outlet pipe downstream of the gate shall be encased in concrete 12" x 36" x 36" deep (Using 1: 3: 5 concrete).

SOUTH DAM

Revisions are shown for the construction of the non-overflow section of the timber crib. No plank flooring shall be used in this section but another 6" x 6" timber shall be placed and the space between it and the upstream planking shall be rock filled.

Revised
9/4/53

PROPOSED RECONSTRUCTION OF DAMS AT MOUNTAIN POND,
SANBORNTON, N. H.

By: New Hampton Village Fire Precinct

BILL OF MATERIAL

Earth Fill at north dam 390 c.y.
Concrete for pipe and gate supports 1 c.y.
Using about 6 bags cement
1 cubic yard clean bank run gravel
66 Lin.Ft. 8" Cast Iron Pipe (to connect to gate valve) (This figure
may be revised later.)

Lumber for concrete base and pipe rings - 96 Bf 1" boards (6" wide)

Spikes and nails for forms, etc.
10# grass seed sow separately } then brush surface to cover seed
50# winter rye sow separately }
400# old hay
200# 7 - 7 - 7 fertilizer or better (worked into soil)

Treated Lumber: (about \$240/M) (About 3500 BF)

5 pcs 2" x 8" stock 12' long for gate manhole (80 bf)
1 pc 4" x 4" stock 12' long (for bottom sill in Section CC)
3 pcs 4" x 4" stock - 16' long (for bottom sill in Section BB)
7 pcs 8" x 8" stock 16' long (for crib)
7 pcs 6" x 6" stock 16' long (for crib)
20 pcs 2" x 8" sheeting 14' long) for double sheeting, flooring and abutments
100 pcs 2" x 8" sheeting 12' long)
3 pcs 8" x 8" stock - 12' long (for crib)
1 pc 8" x 8" stock - 14' long (for crib)
3 pcs 6" x 6" stock - 14' long (for crib)
Spikes and nails for above

F.C.M.
Revised 9/4/53

SOUTH DAM

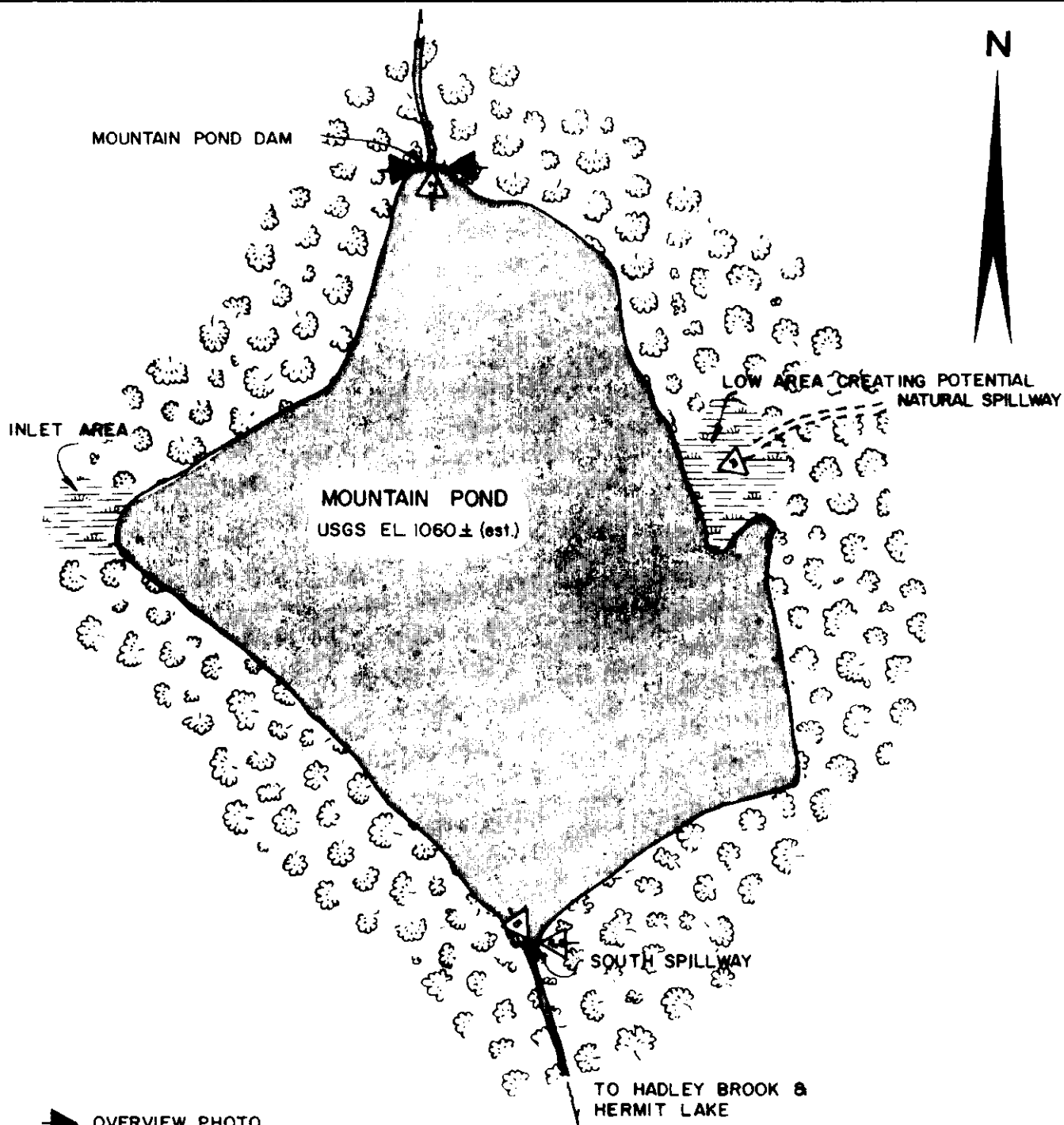
1. The top of new sheeting for the old rock fill dam at the south outlet shall be located at 100.0 feet elevation (one foot lower than the top of the north earth dam). This can be accurately determined by difference in water surface at both points.

2. This sheeting shall be carried at least three feet into the ground by trenching near old sheeting.

3. After the sheeting is in place, the heavy stones shall be placed at the bottom of upstream side of sheeting. Thoroughly compacted soil (impervious if possible) shall be placed on both sides of the sheeting to fill the trench.

4. Earth embankment on the west end may be placed 12 inches higher than the top of sheeting where sheeting would be only 12 inches above the ground. Top level width should be at least three feet, with 2 on 1 side slopes, preferably seeded.

APPENDIX C
SELECTED PHOTOGRAPHS



➡ OVERVIEW PHOTO

➤ APPENDIX C PHOTO

FILE No. 2067

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NEWTON UPPER FALLS, MASS.

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

LOCATION AND ORIENTATION OF PHOTOS

MOUNTAIN POND

NEW HAMPSHIRE

SCALE NO SCALE

DATE JULY 1978



1. Manhole with cover containing gate valve on downstream slope



2. View of downstream channel from outlet pipe headwall



3. View of low area on east side of pond



4. View of South Spillway from left **abutment**



5. Channel downstream of South Spillway



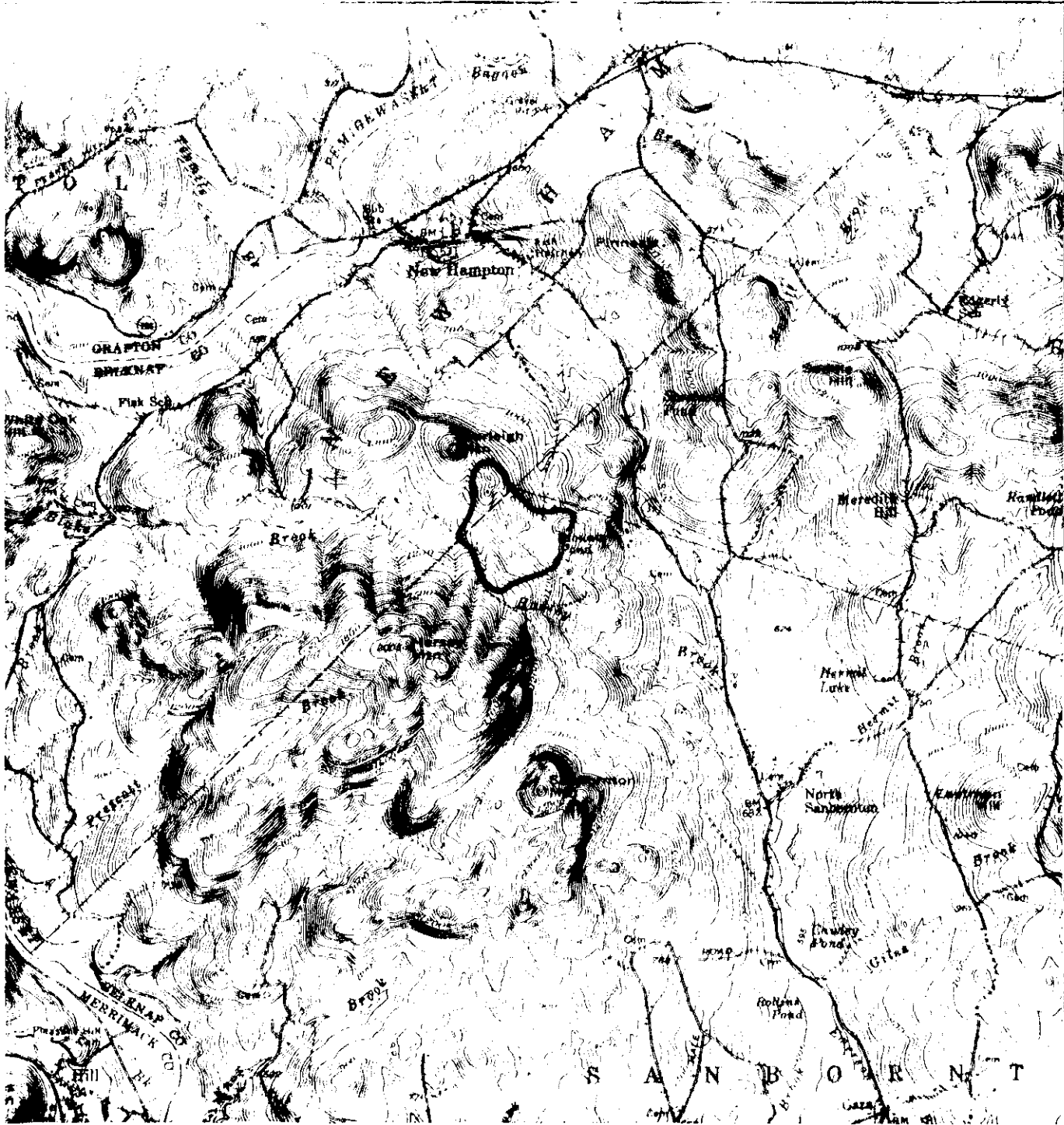
6. Rodent hole near left abutment of South Spillway

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

FOR

MOUNTAIN POND - NORTH OUTLET



- SCALE -



FROM: USGS MT. KEARSARGE, N.H.
QUADRANGLE MAP

GOLDBERG, ZOINO, DUNNICLIFF & ASSOC, INC.
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CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

DRAINAGE AREA

MOUNTAIN POND DAM

NEW HAMPSHIRE

FILE No. 2067

SCALE AS NOTED

DATE JULY 1978

DAMS 148 MOUNTAIN POND #10 7-6-78 DWW 14

SIZE CLASSIFICATION = SMALL

HAZARD CLASSIFICATION = LOW

BASICALLY UNDEVELOPED DOWNSTREAM FOR
2 MILES WITH NUMEROUS OBSTACLES TO
ATTENUATE FLOOD WAVE. IF NIRTH
DAM FAILED FLOOD WAVE WOULD NOT
FLOW DIRECTLY TOWARD NEW HAMPTON,
BUT WOULD BE DIVERTED TOWARD
SPECTACLE POND.

SPILLWAY TEST FLOOD FOR A SMALL
DAM WITH LOW HAZARD CLASS IS

50 YR TO 100 YR PEAK FLOOD,

TO OBTAIN THE Q_{50} AND Q_{100} WE WILL

USE LEBLANC'S REGRESSION EQUATIONS FROM

USGS WATER RES INVESTIGATION 78-47

AREA = 206 ACRES ≈ 0.32 SQ MI

SLOPE : 0.6" TRIAL LENGTH 1" / ft

EL AT .06" = 1070

EL AT .51" = 1250

$$\frac{1250 - 1070}{.51 - .06} = 400 \text{ ft/mi}$$

RAINFALL INDEX:

$I = 2.7$ - used in REGRESSION FOR
NEAREST GAGE # 078000

$$P_{50} = .62 A^{1.05} S^{.54} I^{2.5} = .62 (.32)^{1.05} (400)^{.54} (2.7)^{2.5}$$

$$P_{50} = 57 \text{ cfs}$$

$$P_{100} = .55 A^{1.05} S^{.56} I^{2.72} = .55 (.32)^{1.05} (400)^{.56} (2.7)^{2.72}$$

$$P_{100} = 71 \text{ cfs}$$

DAMS 148 MOUNTAIN POND #10 7-6-78 DWW

THE SMALL DRAINAGE AREA INVOLVED PUTS SOME DOUBT INTO THE APPLICABILITY OF THE LEBLANC REGRESSION EQN'S. AS A CHECK WE WILL USE THE RATIONAL FORMULA.

TIME OF CONCENTRATION,

$$T_c = \frac{1.8(1.1 - C)\sqrt{D}}{\sqrt{S}} \quad \left\{ \begin{array}{l} \text{FROM PAGE 298 OF} \\ \text{INTRODUCTION TO HYDROLOGY} \\ \text{VIGGS, HARGRAVE, KENNEDY} \end{array} \right.$$

WHERE C = RATIONAL RUNOFF COEFF. (USE 0.24 for SDJW,
D = DISTANCE IN FEET 100 year runoff use 0.25,
S = SLOPE IN PERCENT standard C = 0.2)

$$T_c = \frac{1.8(1.1 - .2)\sqrt{1500}}{\sqrt{7.57}} \quad \frac{400}{5160} = .0757$$

$$T_c = 31.95 \text{ min}$$

The 30 min 100 year rainfall from TP-40
is $\approx 1.95"$ for central N.H.
 $\frac{1.95}{30 \text{ min}} = 39"/\text{hour}$

$$Q = CIA$$

$$Q_{100} = (0.25)(39)(206 \text{ acres})$$

$$Q_{100} = 201 \text{ CFS}$$

THE 50 YR rainfall for 30 min is 1.75"

THAT YIELD

$$Q_{50} = 0.24(35)(206)$$

$$Q_{50} = 173 \text{ CFS}$$

DAMS 148 MOUNTAIN POND #10 7-7-78 DWL

GIVEN THE ERROR OF ESTIMATE ASSOCIATED WITH THE REGRESSION EQN FOR SMALL DRAINAGE AREAS WE HAVE DECIDED TO GIVE THE RATIONAL FORMULA SOLUTION MORE CREDENCE IN THIS CASE. THUS WE HAVE SELECTED FOR THE SPILLWAY TEST FLOOD:

$$ST.F = 200 \text{ CFS}$$

THIS IS THE INFLOW TO MOUNTAIN POND. USING THE DISCHARGE-STAGE AND STORAGE-STAGE RELATIONSHIPS AND THE CUE METHODOLOGY FOR DETERMINING REDUCTION IN FLOW DUE TO STORAGE WE FIND: 100 yr, 24 hr depth ≈ 5.0 in.

$$\text{FOR } 200 \text{ CFS, } H \approx 1.46 \text{ FT}$$

WHICH EQUATES TO 2.04" OF RUNOFF

$$Q_{P2} = Q_{P1} \left(1 - \frac{\text{STOR}_1}{S}\right) = 200 \left(1 - \frac{2.04}{5}\right)$$

$$Q_{P2} = 118 \text{ CFS}$$

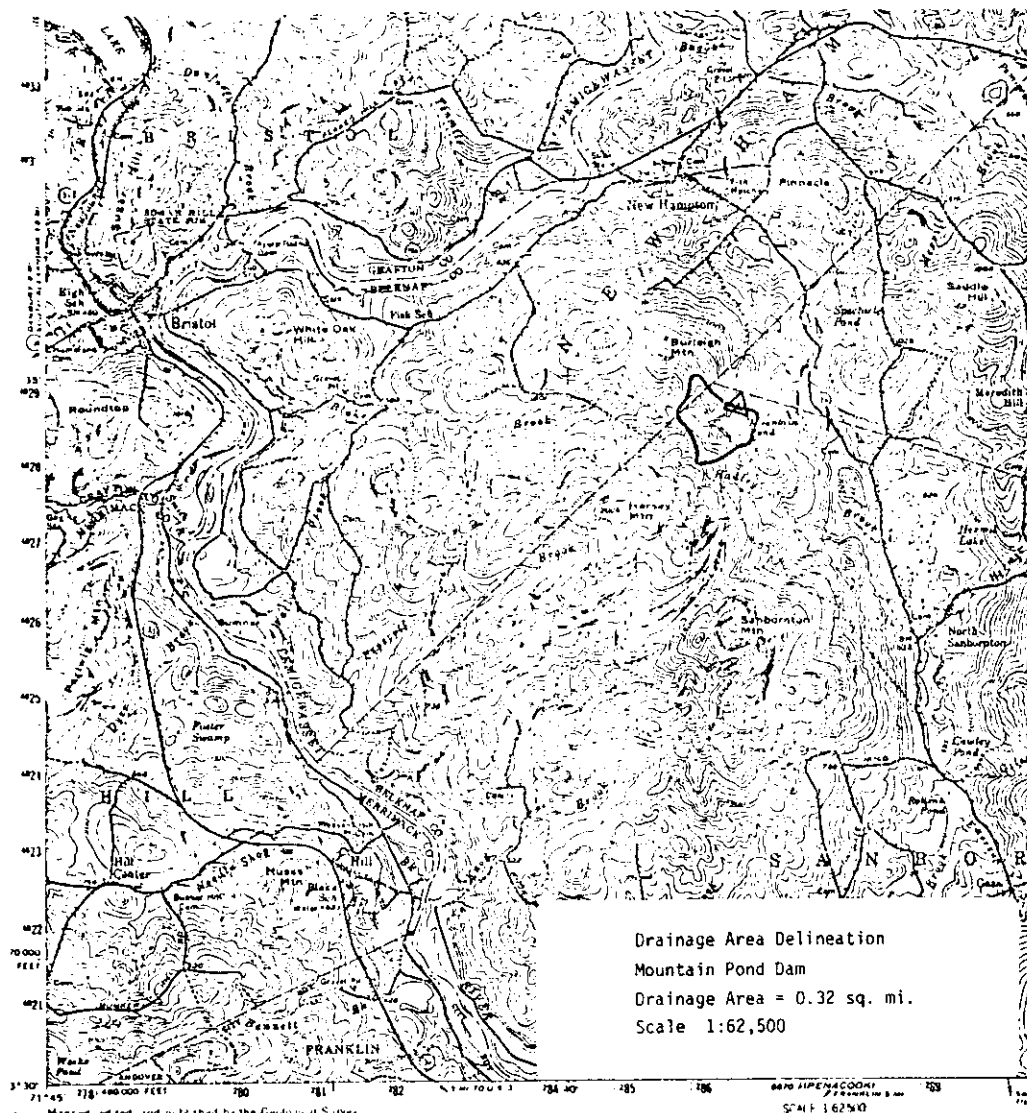
$$\text{FOR } 118 \text{ CFS, } H \approx 1.12 \text{ FT}$$

$$\text{STOR}_2 = 1.57" \text{ OF RUNOFF}$$

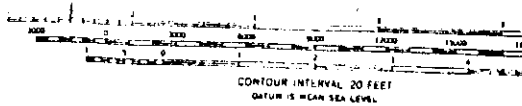
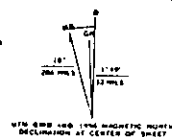
$$\text{AVE STOR} = (2.04 + 1.57)/2 = 1.81"$$

$$Q_{P3} = 200 \left(1 - \frac{1.81}{5}\right) = 127 \text{ cfs}$$

THUS THE REQUIRED STF OF 1425 CFS WILL RESULT IN DISCHARGES OF THE SOUTH SPILLWAY OF ≈ 100 CFS AND ≈ 25 CFS OUT OF THE EAST SWAMP OVERFLOW $H=1.15'$ FOR $Q=125$ CFS



Mappey edited and published by the Geological Survey
 Control by U.S. and N.S. and New Hampshire geodetic survey
 Topography by planimetric surveys 1925 Revised 1956
 Polyconic projection 1927 North American datum
 10 000-foot grid based on New Hampshire coordinate system
 10 meter Universal Transverse Mercator grid ticks
 19 shown in blue
 Area covered by dashed light blue pattern is
 subject to controlled inundation to 100 feet



FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242
 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON R1

DAMS 148 | MOUNTAIN POND #10 | 7-6-78 DWW

STORAGE - STAGE CURVE

ESTIMATE FLAT POND SURCHARGE ABOVE
SPILLWAY CREST.

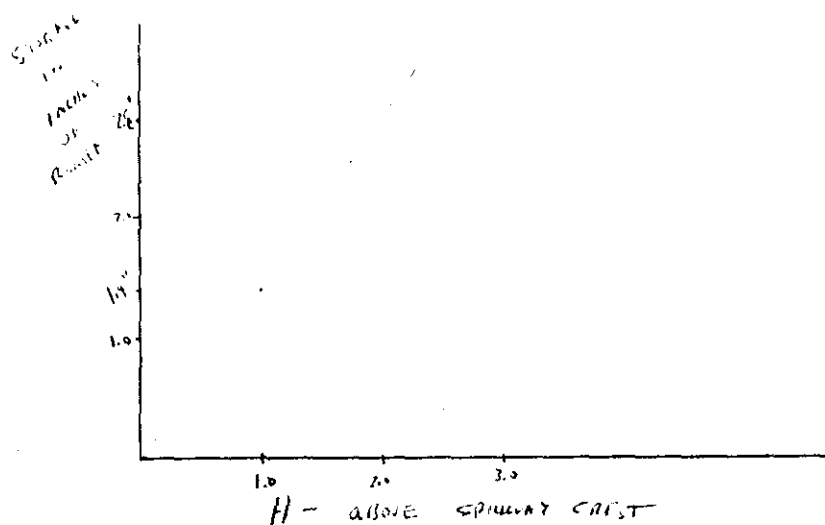
SURFACE AREA OF POND ≈ 24 ac. from
quad sheet

DRAINAGE AREA ≈ 206 ACRES

$$\frac{206}{24} = 8.58$$

1" of runoff would cause 8.58" of rise in lake

1 foot of rise in pond = 1.4" of runoff



DAMS 148

MOUNTAIN POND #10

7-6-78 DWW

7-6-78

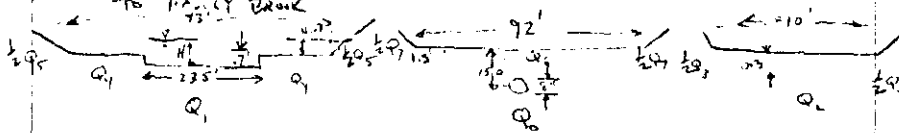
ASSUME 3" ϕ DISCHARGE PIPE IS OPEN ATTIME OF FLOOD, BUT INSIGNIFICANT, SINCE $20 \phi \times .35 H^2 = 9.0$ ft

FAST FLOW

SOUTH SPILLWAY

TO MOUNTAIN POND

NORTH DAM



$$Q_1 = 3.0(23.5)H^{3/2} \quad \text{South Spillway Weir}$$

$$H > 3 \quad Q_2 = 2.8(10)(H-0.3)^{3/2}$$

$$Q_3 = 2.8(H-0.3)[.5(H-0.3)]^{3/2} (2)$$

$$H > 7 \quad Q_4 = 3.0(19.5)(H-7)^{3/2} \quad \text{Rest of South Spillway}$$

$$Q_5 = 2.8(H-7)[.5(H-7)]^{3/2} (2)$$

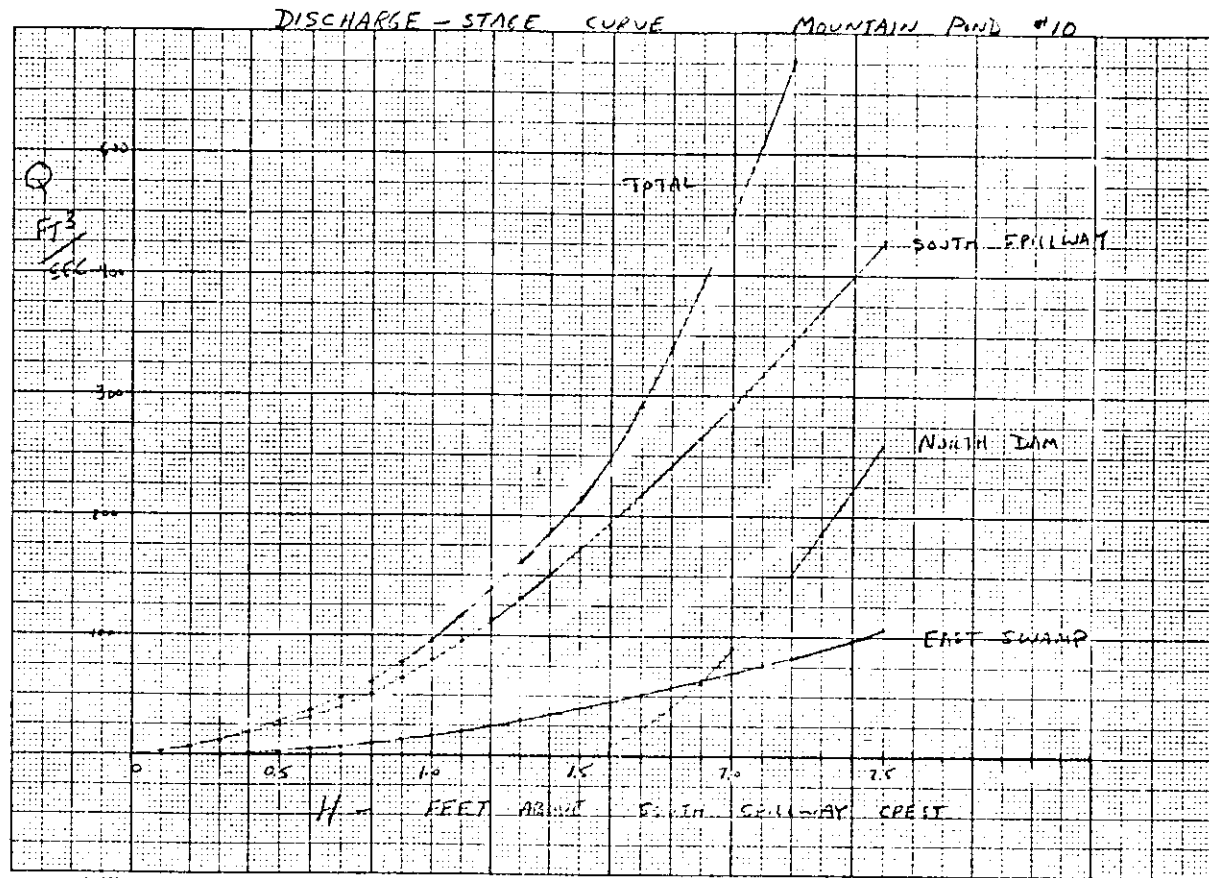
$$H > 15 \quad Q_6 = 2.8(92)(H-15)^{3/2} \quad \text{Overflow North Dam}$$

$$Q_7 = 2.8(H-15)[.5(H-15)]^{3/2} (2)$$

H = water surface elevation above
weir crest on South Spillway

D-9

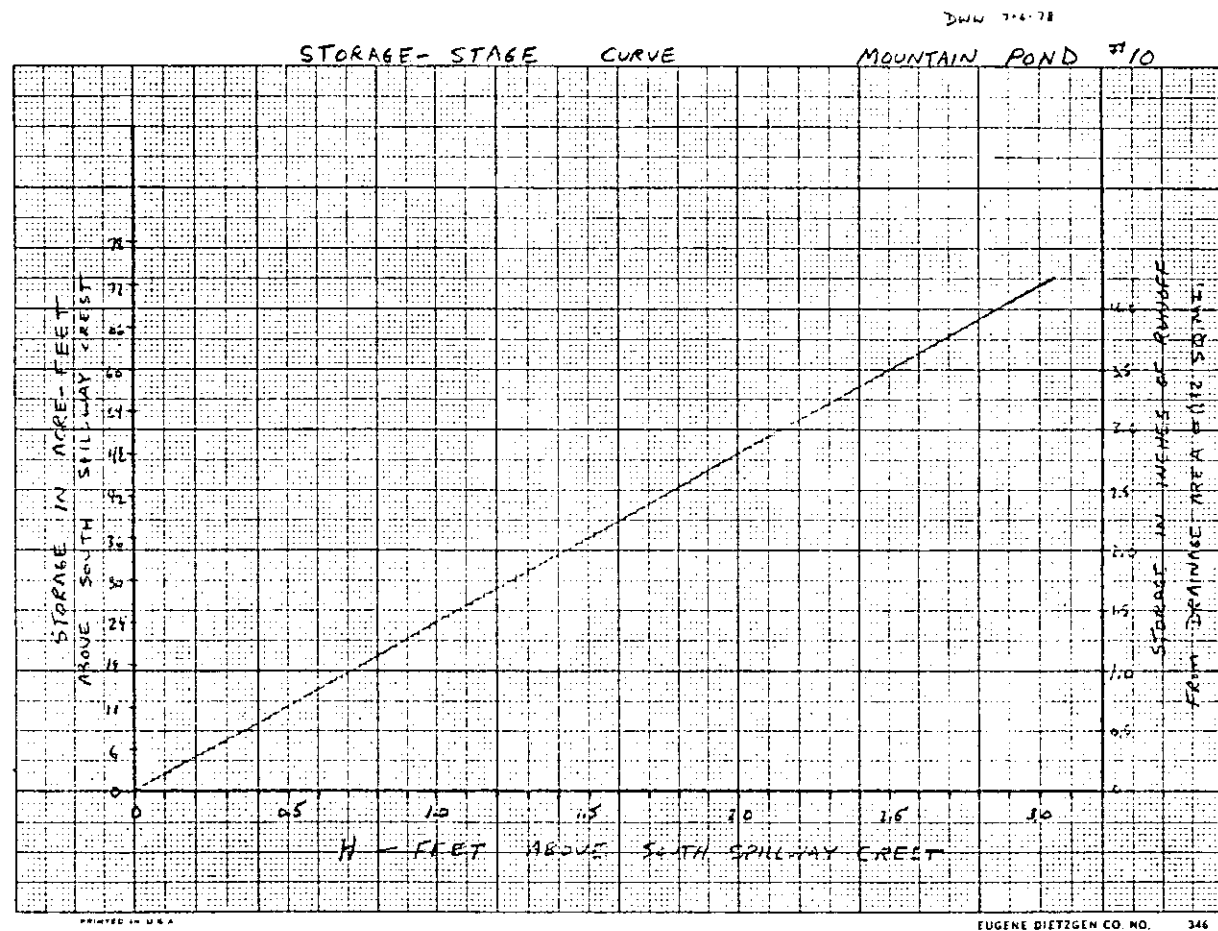
DWW 7-6-78



PRINTED IN U.S.A.

EUGENE DIETZGEN CO. NO. 346

D-10



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LIST
100 REM STAGE DISCHARGE CALC FOR MOUNTAIN POND NORTH DAM JOB 148
110 PAGE
120 C1=3
130 C2=2.8
140 E=1.5
150 PRINT "TOTAL DISCHARGE FROM MOUNTAIN POND AS FUNC OF HEAD"
160 PRINT USING 170:
170 IMAGE // 2T*HEAD"38T"DISCHARGE"
180 PRINT USING 190:
190 IMAGE 10T*TOTAL      NORTH DAM      SOUTH SPILLWAY      EAST SWAMP"
200 FOR H=0.1 TO 2.5 STEP 0.1
210 Q1=C1*23.5*H↑E
220 Q2=0
230 Q3=0
240 IF H<=0.3 THEN 280
250 Q2=C2*10*(H-0.3)↑E
260 Q3=C2*(H-0.3)*(0.5*(H-0.3))↑E
270 Q3=2*Q3
280 Q4=0
290 Q5=0
300 IF H<=0.7 THEN 340
310 Q4=C1*19.5*(H-0.7)↑E
320 Q5=C2*(H-0.7)*(0.5*(H-0.7))↑E
330 Q5=2*Q5
340 Q6=0
350 Q7=0
360 IF H<=1.5 THEN 400
370 Q6=C2*92*(H-1.5)↑E
380 Q7=C2*(H-1.5)*(0.5*(H-1.5))↑E
390 Q7=2*Q7
400 Q8=Q1+Q2+Q3+Q4+Q5+Q6+Q7
410 F1=Q6+Q7
420 F2=Q1+Q4+Q5
430 F3=Q2+Q3

```

```
440 PRINT USING 450:H,Q8,F1,F2,F3
450 IMAGE 1T,2D,1D,8D,12D,13D,17D
460 NEXT H
470 END
```

:

TOTAL DISCHARGE FROM MOUNTAIN POND AS FUNC OF HEAD

HEAD	TOTAL	NORTH DAM	DISCHARGE SOUTH SPILLWAY	EAST SWAMP
0.1	2	0	2	0
0.2	6	0	6	0
0.3	12	0	12	0
0.4	19	0	18	1
0.5	27	0	25	3
0.6	37	0	33	5
0.7	49	0	41	7
0.8	63	0	52	10
0.9	79	0	65	14
1.0	97	0	80	17
1.1	118	0	96	21
1.2	139	0	114	25
1.3	162	0	132	30
1.4	187	0	152	35
1.5	212	0	173	40
1.6	248	0	194	45
1.7	291	23	217	51
1.8	340	42	240	57
1.9	393	65	265	63
2.0	451	91	290	70
2.1	513	120	316	76
2.2	578	152	343	83
2.3	647	185	371	90
2.4	719	221	399	98
2.5	794	260	429	106

```

LIST
100 REM STAGE DISCHARGE CALC FOR MOUNTAIN POND NORTH DAM JOB 148
110 PAGE
120 C1=3
130 C2=2.8
140 E=1.5
150 PRINT "TOTAL DISCHARGE FROM MOUNTAIN POND AS FUNC OF HEAD"
160 PRINT USING 170:
170 IMAGE // 2T"HEAD"30T"DISCHARGE"
180 PRINT USING 190:
190 IMAGE 10T"TOTAL      Q1      Q2      Q3      Q4      Q5      Q6      Q7"
200 FOR H=0.1 TO 2.5 STEP 0.1
210 Q1=C1*23.5*H↑E
220 Q2=0
230 Q3=0
240 IF H<=0.3 THEN 280
250 Q2=C2*10*(H-0.3)↑E
260 Q3=C2*(H-0.3)*(0.5*(H-0.3))↑E
270 Q3=2*Q3
280 Q4=0
290 Q5=0
300 IF H<=0.7 THEN 340
310 Q4=C1*19.5*(H-0.7)↑E
320 Q5=C2*(H-0.7)*(0.5*(H-0.7))↑E
330 Q5=2*Q5
340 Q6=0
350 Q7=0
360 IF H<=1.5 THEN 400
370 Q6=C2*92*(H-1.5)↑E
380 Q7=C2*(H-1.5)*(0.5*(H-1.5))↑E
390 Q7=2*Q7
400 Q8=Q1+Q2+Q3+Q4+Q5+Q6+Q7
410 F1=Q6+Q7
420 F2=Q1+Q4+Q5
430 F3=Q2+Q3

```

```
440 PRINT USING 450:H,Q0,Q1,Q2,Q3,Q4,Q5,Q6,Q7
450 IMAGE 1T,2D,1D,8D, 9D,6D,6D,6D,6D,6D,6D
460 NEXT H
470 END
```

TOTAL DISCHARGE FROM MOUNTAIN POND AS FUNC OF HEAD

HEAD	DISCHARGE							
	TOTAL	Q1	Q2	Q3	Q4	Q5	Q6	Q7
0.1	2	2	0	0	0	0	0	0
0.2	6	6	0	0	0	0	0	0
0.3	12	12	0	0	0	0	0	0
0.4	19	18	1	0	0	0	0	0
0.5	27	25	3	0	0	0	0	0
0.6	37	33	5	0	0	0	0	0
0.7	49	41	7	0	0	0	0	0
0.8	63	50	10	0	2	0	0	0
0.9	79	60	13	1	5	0	0	0
1.0	97	78	16	1	10	0	0	0
1.1	118	81	20	1	15	0	0	0
1.2	139	93	24	2	21	0	0	0
1.3	162	104	28	2	27	1	0	0
1.4	187	117	32	3	34	1	0	0
1.5	212	130	37	3	42	1	0	0
1.6	248	143	42	4	50	2	0	0
1.7	291	156	46	5	58	2	23	0
1.8	340	170	51	5	67	3	42	0
1.9	393	185	57	6	77	3	65	0
2.0	451	199	62	7	87	4	91	0
2.1	513	215	68	9	97	5	120	1
2.2	578	230	73	10	107	5	151	1
2.3	647	246	79	11	118	6	184	1
2.4	719	262	85	13	130	7	220	2
2.5	794	279	91	14	141	9	258	2

DAMS 148 MOUNTAIN POND #10 7-7-78 DWW

CALCULATION OF ESTIMATED DOWNSTREAM DAM
FAILURE FLOOD CONDITIONS - BASED ON COE
"RULE OF THUMB" GUIDANCE, APRIL 1978.

STEP 1: RESERVOIR STORAGE (S) AT TIME OF FAILURE

ASSUME: FAILURE WHEN NORTH DAM CREST IS
OVERTOPPED SINCE DAM IS
OF EARTHFILL CONSTRUCTION.

$$S @ H = 1.5$$

$$S = 36 \text{ AF SURCHARGED} + 150 \text{ ACRE FEET AT FULL POND}$$

STEP 2: PEAK FAILURE DISCHARGE

$$Q_{PI} = \frac{8}{27} W_b \sqrt{g} Y_o^{3/2}$$

WHERE W_b = BREKH WIDTH, ASSUME $40\% \text{ of } 92' = 36'$

$$g = 32.2$$

$$Y_o = 12' \quad \text{--- EST. DEPTH BEHIND DAM}$$

$$Q_{PI} = \frac{8}{27} (36) \sqrt{32.2} (12)^{3/2}$$

$$Q_{PI} = 2516 \text{ CFS.}$$

$$\text{USE } Q = 2500 \text{ CFS}$$



DAMS 148

MOUNTAIN POND #101 7-10-78 DWW

STEP 3: CROSS SECTIONS FOR DOWNSTREAM HAZARDS

ANALYSIS

REACH #1

DAM TO DIVERSION

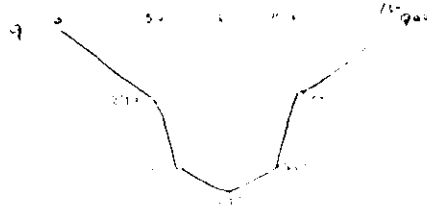
$$\begin{aligned} L &= 2500' \\ S &= 140/2500 \\ &= .056 \\ n &= .1 \end{aligned}$$



REACH #2

DIVERSION TO THE POND

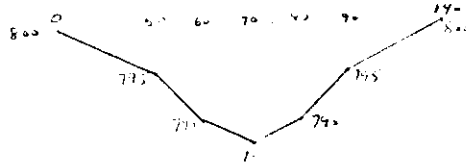
$$\begin{aligned} L &= 3000' \\ S &= 25/3000 \\ &= .008 \\ n &= .1 \end{aligned}$$



REACH #3

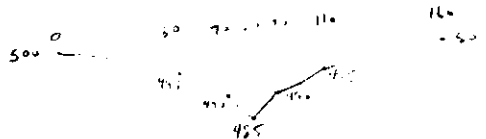
DIVERSION TO THE POND

$$\begin{aligned} L &= 5200' \\ S &= 25/5200 \\ &= .0048 \\ n &= .1 \end{aligned}$$



REACH #4

$$\begin{aligned} L &= 5000' \\ S &= 140/5000 \\ &= .028 \\ n &= .04 \end{aligned}$$



D-20

REACH #1

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.0	985.0	0.0	0.0	0.0	0.0	0.0
0.5	985.5	0.5	2.2	0.2	0.2	0.6
1.0	986.0	2.0	4.5	0.4	1.2	4.1
1.5	986.5	4.5	6.7	0.7	3.4	12.2
2.0	987.0	8.0	8.9	0.9	7.4	26.2
2.5	987.5	12.5	11.2	1.1	13.5	47.5
3.0	988.0	18.0	13.4	1.3	21.9	77.2
3.5	988.5	24.5	15.7	1.6	33.0	116.5
4.0	989.0	32.0	17.9	1.8	47.2	166.3
4.5	989.5	40.5	20.1	2.0	64.6	227.7
5.0	990.0	50.0	22.4	2.2	85.5	301.5
5.5	990.5	60.5	24.6	2.5	110.3	388.0
6.0	991.0	72.0	26.8	2.7	139.1	490.4
6.5	991.5	84.5	29.1	2.9	172.2	607.1
7.0	992.0	98.0	31.3	3.1	209.8	739.7
7.5	992.5	112.5	33.5	3.4	252.2	889.2
8.0	993.0	128.0	35.8	3.6	299.5	1056.2
8.5	993.5	144.5	38.0	3.8	352.1	1241.5
9.0	994.0	162.0	40.2	4.0	410.1	1446.0
9.5	994.5	180.5	42.5	4.2	473.7	1670.3
10.0	995.0	200.0	44.7	4.5	543.2	1915.2
10.5	995.5	222.5	54.8	4.1	566.7	1998.3
11.0	996.0	250.0	64.8	3.9	615.1	2168.9
11.5	996.5	282.5	74.9	3.8	685.0	2415.2
12.0	997.0	320.0	84.9	3.8	775.2	2733.5
12.5	997.5	362.5	95.0	3.8	885.8	3123.2
13.0	998.0	410.0	105.0	3.9	1017.0	3585.9
13.5	998.5	462.5	115.1	4.0	1169.7	4124.4
14.0	999.0	520.0	125.1	4.2	1344.8	4741.8
14.5	999.5	582.5	135.2	4.3	1543.3	5441.7

D-21

REACH #2

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	0
0.0	875.0	0.0	0.0	0.0	0.0	0.0
0.5	875.5	0.5	2.2	0.2	0.2	0.9
1.0	876.0	2.0	4.5	0.4	1.2	5.5
1.5	876.5	4.5	6.7	0.7	3.4	16.2
2.0	877.0	8.0	8.9	0.9	7.4	35.0
2.5	877.5	12.5	11.2	1.1	13.5	63.4
3.0	878.0	18.0	13.4	1.3	21.9	103.2
3.5	878.5	24.5	15.7	1.6	33.0	155.6
4.0	879.0	32.0	17.9	1.8	47.2	222.2
4.5	879.5	40.5	20.1	2.0	64.6	304.2
5.0	880.0	50.0	22.4	2.2	85.5	403.0
5.5	880.5	60.1	23.5	2.6	112.6	530.4
6.0	881.0	70.5	24.6	2.9	142.3	670.5
6.5	881.5	81.1	25.7	3.2	174.6	822.5
7.0	882.0	92.0	26.8	3.4	209.3	986.1
7.5	882.5	103.1	28.0	3.7	246.3	1160.7
8.0	883.0	114.5	29.1	3.9	285.7	1346.2
8.5	883.5	126.1	30.2	4.2	327.3	1542.3
9.0	884.0	138.0	31.3	4.4	371.2	1749.0
9.5	884.5	150.1	32.4	4.6	417.3	1966.0
10.0	885.0	162.5	33.5	4.8	465.5	2193.4
10.5	885.5	175.1	34.7	5.1	515.9	2431.0
11.0	886.0	188.0	35.8	5.3	568.5	2678.9
11.5	886.5	201.1	36.9	5.5	623.3	2936.9
12.0	887.0	214.5	38.0	5.6	680.3	3205.2
12.5	887.5	228.1	39.1	5.8	739.4	3483.8
13.0	888.0	242.0	40.2	6.0	800.7	3772.5
13.5	888.5	256.1	41.4	6.2	864.1	4071.6
14.0	889.0	270.5	42.5	6.4	929.8	4381.0
14.5	889.5	285.1	43.6	6.5	997.7	4700.8

REACH #3

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.0	785.0	0.0	0.0	0.0	0.0	0.0
0.5	785.5	0.5	2.2	0.2	0.2	0.6
1.0	786.0	2.0	4.5	0.4	1.2	4.0
1.5	786.5	4.5	6.7	0.7	3.4	11.9
2.0	787.0	8.0	8.9	0.9	7.4	25.7
2.5	787.5	12.5	11.2	1.1	13.5	46.6
3.0	788.0	18.0	13.4	1.3	21.9	75.8
3.5	788.5	24.5	15.7	1.6	33.0	114.4
4.0	789.0	32.0	17.9	1.8	47.2	163.3
4.5	789.5	40.5	20.1	2.0	64.6	223.6
5.0	790.0	50.0	22.4	2.2	85.5	296.1
5.5	790.5	60.5	24.6	2.5	110.3	381.8
6.0	791.0	72.0	26.8	2.7	139.1	481.5
6.5	791.5	84.5	29.1	2.9	172.2	596.1
7.0	792.0	98.0	31.3	3.1	209.8	726.4
7.5	792.5	112.5	33.5	3.4	252.2	873.2
8.0	793.0	128.0	35.8	3.6	299.5	1037.2
8.5	793.5	144.5	38.0	3.8	352.1	1219.2
9.0	794.0	162.0	40.2	4.0	410.1	1419.9
9.5	794.5	180.5	42.5	4.2	473.7	1640.2
10.0	795.0	200.0	44.7	4.5	543.2	1880.6
10.5	795.5	222.5	54.8	4.1	566.7	1962.3
11.0	796.0	250.0	64.8	3.9	615.1	2129.8
11.5	796.5	282.5	74.9	3.8	685.0	2371.7
12.0	797.0	320.0	84.9	3.8	775.2	2684.2
12.5	797.5	362.5	95.0	3.8	885.8	3066.9
13.0	798.0	410.0	105.0	3.9	1017.0	3521.3
13.5	798.5	462.5	115.1	4.0	1169.7	4050.1
14.0	799.0	520.0	125.1	4.2	1344.8	4656.3
14.5	799.5	582.5	135.2	4.3	1543.3	5343.6

REACH #4

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.0	485.0	0.0	0.0	0.0	0.0	0.0
0.5	485.5	0.5	2.2	0.2	0.2	1.1
1.0	486.0	2.0	4.5	0.4	1.2	7.3
1.5	486.5	4.5	6.7	0.7	3.4	21.5
2.0	487.0	8.0	8.9	0.9	7.4	46.3
2.5	487.5	12.5	11.2	1.1	13.5	83.9
3.0	488.0	18.0	13.4	1.3	21.9	136.5
3.5	488.5	24.5	15.7	1.6	33.0	205.9
4.0	489.0	32.0	17.9	1.8	47.2	294.0
4.5	489.5	40.5	20.1	2.0	64.6	402.5
5.0	490.0	50.0	22.4	2.2	85.5	533.1
5.5	490.5	61.0	26.5	2.3	106.4	663.3
6.0	491.0	74.0	30.6	2.4	133.3	831.1
6.5	491.5	89.0	34.7	2.6	166.7	1039.2
7.0	492.0	106.0	38.9	2.7	207.0	1298.5
7.5	492.5	125.0	43.0	2.9	254.8	1588.1
8.0	493.0	146.0	47.1	3.1	310.5	1935.4
8.5	493.5	169.0	51.2	3.3	374.7	2335.5
9.0	494.0	194.0	55.3	3.5	447.0	2791.5
9.5	494.5	221.0	59.5	3.7	530.5	3306.4
10.0	495.0	250.0	63.6	3.9	623.0	3883.3
10.5	495.5	282.5	73.6	3.8	692.6	4317.0
11.0	496.0	320.0	83.7	3.8	782.0	4879.3
11.5	496.5	362.5	93.7	3.9	893.5	5569.2
12.0	497.0	410.0	103.8	4.0	1025.0	6389.1
12.5	497.5	462.5	113.8	4.1	1178.1	7343.4
13.0	498.0	520.0	123.9	4.2	1353.7	8437.7
13.5	498.5	582.5	133.9	4.3	1552.7	9678.4
14.0	499.0	650.0	144.0	4.5	1776.3	11071.9
14.5	499.5	722.5	154.0	4.7	2025.5	12625.1

DAMS 148

MOUNTAIN POND #10

7-11-78 DWW

REACH 1

$$Q_{P1} = 2500 \text{ cfs}$$

$$H = f(Q_{P1}) = 11.6$$

$$\text{AREA @ } 11.6 = 290 \text{ ft}^2$$

$$V_1 = L \times \text{AREA} = 2500 \times 290 = 725,000 / 43560 = 16.64 \text{ AF}$$

$$Q_{P2T} = Q_{P1} \left(1 - \frac{16.64}{186}\right) = 2500 \left(1 - \frac{16.64}{186}\right) \quad \frac{16.64}{186}$$

$$Q_{P2T} = 2276$$

$$H = f(Q_{P2T}) = 11.3$$

$$\text{AREA} = 270 \text{ ft}^2$$

$$V_2 = L \times A = 2500 \times 270 = 675,000 / 43560 = 15.5 \text{ AF}$$

$$V_{\text{AVG}} = \frac{16.64 + 15.5}{2} = 16.07$$

$$Q_{P2} = 2500 \left(1 - \frac{16.07}{186}\right) = 2285 \text{ cfs}$$

$$\text{REACH 2} \quad Q_{P1} = 2285 \left(1.6\right)^* = 1370$$

$$H = f(Q_{P1}) = 8.0'$$

$$\text{AREA} = 114.5 \text{ ft}^2$$

$$V1 = 3000' \times 114.5 = 343,500 \text{ ft}^3 \quad \frac{343,500}{43560} = 7.88 \text{ AF} \quad \frac{16.64}{43560}$$

$$Q_{P2T} = 1370 \left(1 - \frac{7.88}{186}\right) = 1321$$

$$H \approx 7.94$$

NO ATTENUATION

$$Q_{P2} \approx 1321, \text{ say } 1320$$

* 60% of flow enters reach 2, 40% enters reach 3

DAMS 148 MOUNTAIN POND 11/10 7-11-78 DWL

REACH 3

$$Q_{P1} = 2285(.4) = 914 \text{ cfs}$$

$$H = f(Q_{P1}) = 7.6'$$

$$\text{AREA} = 115.7 \text{ ft}^2$$

$$V_1 = 5200 \times 115.7 = 601,740 \text{ ft}^3 \quad \frac{601,740}{43560} = 13.8 \text{ AF}$$

$$Q_{P2T} = 914 \left(1 - \frac{13.8}{186}\right) = 846 \text{ cfs}$$

$$H = f(Q_{P2T}) = 7.4'$$

$$\text{AREA} = 110 \text{ ft}^2$$

$$V = 5200 \times 110 = 572,000 \text{ ft}^3 \quad \frac{572,000}{43560} = 13.1 \text{ AF}$$

$$V_{AVE} = \frac{13.8 + 13.1}{2} = 13.45$$

$$Q_{P2} = 914 \left(1 - \frac{13.45}{186}\right) = 847 \text{ cfs, say } 850$$

REACH 4

$$Q_{P1} = 847 \text{ cfs}$$

$$H = f(Q_{P1}) = 6.0 \text{ ft}$$

$$\text{AREA} = 74 \text{ ft}^2$$

$$V_1 = 5000 \times 74 = 370,000 \text{ ft}^3 \quad \frac{370,000}{43560} = 8.49 \text{ AF}$$

$$Q_{P2T} = 847 \left(1 - \frac{8.49}{186}\right) = 808 \text{ cfs}$$

$$H = f(Q_{P2T}) = 5.9'$$

$$\text{AREA} = 72 \text{ ft}^2$$

$$V_1 = 5000 \times 72 = 360,000 \text{ ft}^3 \quad \frac{360,000}{43560} = 8.26 \text{ AF}$$

$$V_{AVE} = 8.38$$

$$Q_{P2} = 847 \left(1 - \frac{8.38}{186}\right) = 808 \text{ cfs} \approx 810 \text{ cfs}$$

APPENDIX E

INFORMATION AS CONTAINED IN

THE NATIONAL INVENTORY OF DAMS